REMARKS/ARGUMENTS

Claims 2-6, 8 and 10-12 are pending in this application. Claims 8 and 5-6 have been amended.

Claims 8, 2-4 and 10-12 stand rejected under 35 USC §103 as being unpatentable over Patel et al. (US Patent No. 5,374,578) ("Patel") in view of either Emesh et al. (U.S. Patent No. 5,728,603) ("Emesh") or Chivukula et al. (U.S. Patent No. 6,066,581) ("Chivukula"). The rejection is respectfully traversed.

The claimed invention relates to a method of fabricating a semiconductor device according to which an oxygen-deficient dielectric film is subjected to wet oxidation in a rapid thermal process chamber. As such, amended independent claim 8 recites a method of fabricating a semiconductor device by "depositing an oxygen-deficient dielectric film having a dielectric constant of at least about 25 over an underlying layer," "subjecting the dielectric film to a wet oxidation with a mixture of hydrogen and oxygen gases in a rapid thermal process chamber at a temperature of at least about 450 °C and for a duration which increases the oxygen content of the dielectric film," and then "subjecting the dielectric film to a heat treatment in an ambient comprising a stabilizing gas selected from the group consisting of N_2, O_2, O_3, NO, and N_2O."

Patel relates to a "method for forming a ferroelectric capacitor using ozone anneals." (Col. 2, lines 7-9). According to Patel, anneal processes are performed in "an ozone atmosphere using a rapid thermal anneal process (RTA) or a furnace anneal." (Col. 3, lines 63-66). This is because "ozone is preferred (to oxygen) in that it significantly decreases the number of lead (Pb) atoms lost during annealing as compared to using a conventional oxygen anneal in a furnace." (Col. 4, lines 18-22).

Emesh relates to a method of forming a crystalline perovskite phase of a ferroelectric dielectric material for an integrated circuit. (Abstract). According to Emesh, "a layer of amorphous ferroelectric precursor material" is deposited on a substrate and then

annealed at "a temperature sufficient to cause a phase transformation to a ferroelectric crystalline perovskite phase" in an oxidizing ambient in presence of water vapors. (Col. 3, lines 21-30). The annealing step is carried out at "a temperature below 500 °C." (Col. 3, lines 41-45). This way, "many of the problems . . . related to the relatively high temperature which is required for processing deposited ferroelectric layers to form a crystalline phase of the ferroelectric dielectric material" are avoided. (Col. 3, lines 7-14).

Chivukula relates to a "sol-gel precursor mixture forming a perovskite ferroelectric material and a method for forming a ferroelectric material." (Abstract). Chivukula teaches that water vapors are introduced into "an annealing atmosphere comprising oxygen" for the formation of the ferroelectric material. (Col. 13, lines 36-40). Chivukula also teaches that "[O]zone is preferably added to the annealing atmosphere to speed up oxidation." (Col. 13, lines 46-47).

The subject matter of claims 8, 2-4 and 10-12 would not have been obvious over Patel in view of either Emesh or Chivukula. First, not all claim limitations are taught or suggested by the prior art, either alone or in combination. Patel is silent about a wet oxidation process, much less about "a *wet oxidation* with a mixture of *hydrogen and oxygen* gases in a rapid thermal process chamber at a temperature of at least about 450 °C and for a duration which increases the oxygen content of the dielectric film," as amended independent claim 8 recites (emphasis added). Similarly, Emesh fails to teach wet oxidation with a mixture of hydrogen and oxygen. Emesh teaches rapid thermal annealing where "[W]ater vapour was conveniently introduced into the annealing atmosphere . . . by passing oxygen (O_2) through a double bubbler containing purified deionized (DI) water." (Col. 5, lines 22-26). Thus, Emesh is silent about the step of "subjecting the dielectric film to a wet oxidation with a mixture of *hydrogen and oxygen* gases in a rapid thermal process chamber at a temperature of at least about 450 °C and for a duration which increases the oxygen content of the dielectric film," as independent amended claim 8 recites. Finally, Chivukula is also silent about "a wet oxidation with a mixture of *hydrogen and oxygen* gases in a rapid thermal process chamber at a temperature," as independent amended claim 8

recites. Chivukula teaches only water vapors in the presence of either oxygen or oxygen/ozone.

Second, no suggestion or motivation to combine the references exists. Courts have generally held that, to establish a *prima facie* case of obviousness, "[I]t is insufficient that the prior art disclosed the components of the patented device, either separately or used in other combinations; there must be some teaching, suggestion, or incentive to make the combination made by the inventor." Northern Telecom, Inc. v. Datapoint Corp., 908 F.2d 931, 934, 15 U.S.P.Q.2d 1321, 1323 (Fed. Cir. 1990). This way, "the inquiry is not whether each element existed in the prior art, but whether the prior art made obvious the invention as a whole for which patentability is claimed." Hartness Int'l, Inc. v. Simplimatic Engineering Co., 819 F.2d 1100, 1108, 2 U.S.P.Q.2d 1826, 1832 (Fed. Cir. 1987). Accordingly, a determination of obviousness "must involve more than indiscriminately combining prior art; a motivation or suggestion to combine must exist." Pro-Mold & Tool Co., 75 F.3d at 1573.

In the present case, Patel expressly notes that "ozone is preferred" to oxygen because "[O]zone anneals provide a more complete method of supplying oxygen to the ferroelectric material than oxygen anneals." (Col. 2, lines 11-13). This way, Patel emphasizes that the drawbacks of the prior art oxygen anneal processes "can be reduced, or even eliminated." (Col. 1, lines 45-47). In contrast, both Emesh and Chivukula teach anneal atmospheres which necessarily include oxygen. As noted above, Emesh teaches oxygen (O_2) passing a double bubbler containing purified deionized (DI) water, while Chivukula teaches water vapors in the presence of either oxygen or oxygen/ozone. Accordingly, one skilled in the art would not have been motivated to combine either Emesh or Chivukula, which teach the use of oxygen, with Patel, which teaches against the use of oxygen. Accordingly, the Office Action failed to establish a *prima facie* case of obviousness and withdrawal of the rejection of claims 8, 2-4 and 10-12 is respectfully requested.

Claims 5-6 stand rejected under 35 USC §103 as being unpatentable over Patel

et al. (US Patent No. 5,374,578) ("Patel") in view of either Emesh et al. (U.S. Patent No. 5,728,603) ("Emesh") or Chivukula et al. (U.S. Patent No. 6,066,581) ("Chivukula"), as applied to claims 8, 2-4 and 10-12, and in further view of pages 157-160 of Van Zant, *Microchip Fabrication, A Practical Guide to Semiconductor Processing*, 3d Ed. McGraw-Hill (New York 1997) ("Zant"). The rejection is respectfully traversed.

Amended claims 5 and 6 recite that the "ratio of hydrogen to oxygen gases in the mixture is in the range of about 0.1 to about 0.5" (claim 5) and "in the range of about 0.1 to about 0.8" (claim 6). Amended claims 5 and 6 depend on independent amended claim 8, and for the reasons described above, the subject matter of these claims would not have been obvious over Patel in view of either Emesh or Chivukula, and in further view of Zant. Accordingly, withdrawal of the rejection of claims 5 and 6 is respectfully requested.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "**Version with markings to show changes made.**"

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

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Respectfully submitted,

By_____

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Version With Markings to Show Changes Made

8. (twice amended) A method of fabricating a semiconductor device comprising:

depositing an oxygen-deficient dielectric film having a dielectric constant of at least about 25 over an underlying layer;

subjecting the dielectric film to a wet oxidation with a mixture of hydrogen and oxygen gases in a rapid thermal process chamber at a temperature of at least about 450 °C and for a duration which increases the oxygen content of the dielectric film; and

subjecting the dielectric film to a heat treatment in an ambient comprising a stabilizing gas selected from the group consisting of N_2, O_2, O_3, NO, and N_2O.

5. (twice amended) The method of claim 8 wherein [subjecting the dielectric film to a wet oxidation includes heating a mixture of hydrogen and oxygen gases wherein] the ratio of hydrogen to oxygen gases in the mixture is in the range of about 0.1 to about 0.5.

6. (twice amended) The method of claim 8 wherein [subjecting the dielectric film to a wet oxidation includes heating a mixture of hydrogen and oxygen gases wherein] the ratio of hydrogen to oxygen gases in the mixture is in the range of about 0.1 to about 0.8.